What is claimed is:

CLAIMS

1. An optical packet switching method for use at a switching node that receives a first optical packet on a first input path at a first bit-rate and a second optical packet on a second input path at a second bit-rate, the method comprising:

routing the first optical packet to a destination over a first channel wavelength and the second optical packet to said destination over a second channel wavelength if a magnitude of a difference between the first bit-rate and the second bit-rate exceeds a bit-rate difference threshold, and

routing the first optical packet and the second optical packet to said destination at separate time slots over a single channel wavelength if said magnitude of a difference between the first bit-rate and the second bit-rate does not exceed said bit-rate difference threshold.

2. The method according to claim 1 and wherein each of said first optical packet and said second optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

3. The method according to claim 1 and also comprising determining said magnitude of a difference between the first bit-rate and the second bit-rate prior to said routing.

4. The method according to claim 3 and wherein said determining comprises:

obtaining a first bit-rate identifier associated with the first optical packet by analyzing a first header associated with the first optical packet;

obtaining a second bit-rate identifier associated with the second optical packet by analyzing a second header associated with the second optical packet; and

comparing said first bit-rate identifier with said second bit-rate identifier to obtain said magnitude of a difference between the first bit-rate and the second bit-rate.

5. The method according to claim 4 and wherein each of said first bit-rate identifier and said second bit-rate identifier comprises at least one of the following: a source identifier; a label; and an overhead byte.

6. The method according to claim 1 and wherein said bit-rate difference threshold is about zero.

7. An optical packet switching method for use at a switching node that receives a first optical packet on a first input path at a first bit-rate and a second optical packet on a second input path at a second bit-rate, the method comprising:

determining a magnitude of a difference between the first bit-rate and the second bit-rate; and

if said magnitude of a difference between the first bit-rate and the second bit-rate exceeds a bit-rate difference threshold:

switching said first optical packet to a destination via a first optical communication switch that is operatively associated with said destination and said second optical packet to said destination via a second optical communication switch that is operatively associated with said destination, and

if said magnitude of a difference between the first bit-rate and the second bit-rate does not exceed the bit-rate difference threshold:

switching said first optical packet and said second optical packet to said destination via a single optical communication switch that is operatively associated with said destination.

8. The method according to claim 7 and wherein each of said first optical packet and said second optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

9. An optical packet switching method for use at a switching node that receives N series of optical packets on N input paths at N bit-rates respectively, where N is an integer greater than two, the method comprising:

arranging said N series of optical packets as K groups of series of optical packets, where $K \leq N$ and the K groups are characterized in that each group includes series of optical packets having substantially similar bit-rates, and bit-rates of series in each group differ from bit-rates of series in other groups;

allocating K separate channel wavelengths for communicating said K groups of series of optical packets to a destination; and

routing optical packets in each group on a corresponding one of the K separate channel wavelengths to said destination.

10. The method according to claim 9 and wherein each optical packet in said N series of optical packets comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

11. The method according to claim 9 and wherein said arranging comprises determining said N bit-rates by obtaining a bit-rate identifier from a header associated with at least one optical packet in each of the N series.

12. An optical packet switching method for switching to an output path optical packets provided at a plurality of bit-rates on a plurality of input paths, the method comprising:

balancing the bit-rates of the optical packets with respect to each other up to a bit-rate difference level within a predetermined equalization range so as to obtain optical packets having balanced bit-rates; and

switching said optical packets having balanced bit-rates to said output path on a single switched channel wavelength.

13. The method according to claim 12 and wherein each optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

14. The method according to claim 12 and wherein said predetermined equalization range is of about zero range.

15. A method of resolving bandwidth contention between a first optical packet arriving on a first path and a second optical packet arriving on a second path, the method comprising:

determining that the bandwidth contention can be resolved by compaction of at least one of the first optical packet and the second optical packet;

compacting said at least one of the first optical packet and the second optical packet in response to said determining; and

switching the first optical packet and the second optical packet, at least one of which being in a compacted form, to a destination on a single switched channel wavelength.

16. The method according to claim 15 and wherein each of said first optical packet and said second optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

17. The method according to claim 15 and wherein said determining comprises determining a compaction factor, and said compacting comprises compacting said at least one of the first optical packet and the second optical packet by said compaction factor.

18. The method according to claim 15 and also comprising updating the destination of said compacting.

19. The method according to claim 15 and also comprising routing a replica of at least one of the following to monitoring circuitry: the first optical packet; the second optical packet; a compacted form of the first optical packet; and a compacted form of the second optical packet.

20. A method of resolving bandwidth contention between a first optical packet arriving on a first path and a second optical packet arriving on a second path, the method comprising:

polarizing the first optical packet in a first polarization direction to obtain a first polarized optical packet, and the second optical packet in a second polarization direction to obtain a second polarized optical packet; and

merging the first polarized optical packet and the second polarized optical packet onto a single switched channel wavelength.

21. The method according to claim 20 and wherein said first polarization direction and said second polarization direction are orthogonal.

22. The method according to claim 20 and wherein each of said first optical packet and said second optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

23. An optical packet switching method for switching an optical packet provided at a first bit-rate, the method comprising:

compacting said optical packet provided at a first bit-rate so as to generate a compact optical packet at a second bit-rate, the second bit-rate being greater than the first bit-rate; and

switching the compact optical packet to an output path associated with a destination.

24. The method according to claim 23 and wherein said optical packet comprises one of the following: a fixed-length optical packet; and a variable-length optical packet.

25. The method according to claim 23 and also comprising updating the destination of said compacting.

26. An optical packet switch for switching to an output path associated with a destination a first optical packet received on a first input path at a first bit-rate and a second optical packet received on a second input path at a second bit-rate, the optical packet switch comprising:

a switching/routing control unit; and

at least one switching node operatively controlled by said switching/routing control unit and operative to route the first optical packet to said output path over a first channel wavelength and the second optical packet to said output path over a second channel wavelength if a magnitude of a difference between the first bit-rate and the second bit-rate exceeds a bit-rate difference threshold, and to route the first optical packet and the second optical packet to said output path at separate time slots over a single channel wavelength if said magnitude of a difference between the first bit-rate and the second bit-rate does not exceed said bit-rate difference threshold.

27. An optical packet switch for switching to a destination a first optical packet received on a first input path at a first bit-rate and a second optical packet received on a second input path at a second bit-rate, the optical packet switch comprising:

a switching/routing control unit operative to determine a magnitude of a difference between the first bit-rate and the second bit-rate; and

at least one switching node operatively controlled by said switching/routing control unit and operative, if said magnitude of a difference between the first bit-rate and the second bit-rate exceeds a bit-rate difference threshold, to switch said first optical packet to said destination via a first optical communication switch that is operatively associated with said destination and said second optical packet to said destination via a second optical communication switch that is operatively associated with said destination, and, if said magnitude of a difference between the first bit-rate and the second bit-rate does not exceed said bit-rate difference threshold, to switch said first optical packet and said second optical packet to said destination via a single optical communication switch that is operatively associated with said destination.

28. An optical packet switch for switching to a destination N series of optical packets received on N input paths at N bit-rates respectively, where N is an integer greater than two, the optical packet switch comprising:

a switching/routing control unit operative to arrange said N series of optical packets as K groups of series of optical packets, where $K \leq N$ and the K groups are characterized in that each group includes series of optical packets having substantially similar bit-rates, and bit-rates of series in each group differ from bit-rates of series in other groups, the switching/routing control unit being further operative to allocate K separate channel wavelengths for communicating said K groups of series of optical packets to said destination; and

at least one switching node operatively controlled by said switching/routing control unit and operative to route optical packets in each group on a corresponding one of the K separate channel wavelengths to said destination.

29. An optical packet switch for switching optical packets provided at a plurality of bit-rates on a plurality of input paths to an output path, the optical packet switch comprising:

a bit-rate balancing apparatus operative to balance the bit-rates of the optical packets with respect to each other up to a bit-rate difference level within a predetermined equalization range so as to obtain optical packets having balanced bit-rates; and

at least one switching node operatively associated with said bit-rate balancing apparatus and operative to switch the optical packets having balanced bit-rates to said output path on a single switched channel wavelength.

30. The optical packet switch according to claim 29 and wherein said bit-rate balancing apparatus comprises:

a control unit; and

an interface unit operatively controlled by the control unit and operative to receive said optical packets provided at a plurality of bit-rates on a plurality of input paths and to employ at least one packet compactor/expander which is operative to compact/expand at least some of said optical packets in order to obtain said optical packets having balanced bit-rates.

31. Apparatus for resolving bandwidth contention between a first optical packet arriving on a first path and a second optical packet arriving on a second path, the apparatus comprising:

a switching/routing control unit operative to generate a determination that the bandwidth contention can be resolved by compaction of at least one of the first optical packet and the second optical packet;

at least one packet compactor operatively controlled by said switching/routing control unit and operative to compact said at least one of the first optical packet and the second optical packet in accordance with said determination; and

at least one switching node operatively controlled by said switching/routing control unit and operative to switch the first optical packet and the second optical packet, at least one of which being in a compacted form, to a destination on a single switched channel wavelength.

32. A polarizing apparatus for resolving bandwidth contention between a first optical packet arriving on a first path and a second optical packet arriving on a second path, the apparatus comprising:

at least one polarizer operative to polarize the first optical packet in a first polarization direction to obtain a first polarized optical packet, and the second optical packet in a second polarization direction to obtain a second polarized optical packet; and

a combiner operative to merge the first polarized optical packet and the second polarized optical packet onto a single switched channel wavelength.

33. An optical packet switch for switching an optical packet provided at a first bit-rate, the optical packet switch comprising:

a switching/routing control unit;

at least one packet compactor/expander operatively controlled by said switching/routing control unit and operative to compact said optical packet provided at the first bit-rate so as to generate a compact optical packet at a second bit-rate, the second bit-rate being greater than the first bit-rate; and

at least one switching node operatively associated with said at least one packet compactor/expander and said switching/routing control unit and operative to switch the compact optical packet to an output path associated with a destination.